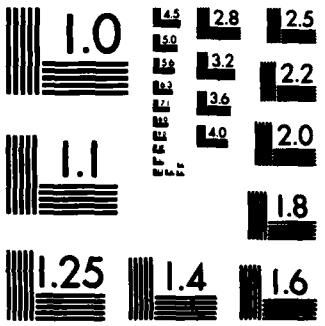
AD-A154 331 LONGITUDINAL STUDY OF CARDIOVASCULAR DISEASE IN US NAVY 1/1
PILOTS(U) NAVAL HEALTH RESEARCH CENTER SAN DIEGO CA
A HOIBERG FEB 85 NAVHLTHRSCHC-85-7

UNCLASSIFIED F/G 6/5 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(2)

LONGITUDINAL STUDY OF CARDIOVASCULAR DISEASE IN U.S. NAVY PILOTS

A. HOIBERG

REPORT NO. 85-7

NAVAL HEALTH RESEARCH CENTER
P.O. BOX 85122
SAN DIEGO, CALIFORNIA 92138-9174

NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
BETHESDA, MARYLAND

LONGITUDINAL STUDY OF CARDIOVASCULAR DISEASE IN U.S. NAVY PILOTS

Anne Hoiberg
Environmental Medicine Department
Naval Health Research Center
P. O. Box 85122
San Diego, California 92138-9174

Report No. 85-7 was supported by the Naval Medical Research and Development Command, Department of the Navy, under research Work Unit 62758N MF 528.01A-0001. The views presented in this paper are those of the author. No endorsement by the Department of the Navy has been given nor should be inferred.

SUMMARY

Problem

Members of the U.S. military aviation community are concerned about the consequences of cardiovascular disease (CVD) because these can include inflight incapacitation and loss of life and aircraft as well as major career changes and health care involvement for pilots who survive the initial CVD incident.

Objective

The purpose of this longitudinal study was to assess the aftereffects of CVD in U.S. Navy pilots who were diagnosed with acute myocardial infarction (AMI), chronic ischemic heart disease (CIHD), essential benign hypertension (EBH), or symptomatic heart disease (SHD) during a 12.5-year time period. The specific subsequent life events included deaths, hospital admissions, medical boards, physical evaluation boards, flight status, and active duty status.

Approach

On the basis of diagnoses reported on records of deaths, hospitalizations, medical boards, and physical evaluation boards during the July 1967 to December 1979 time period, 150 U.S. Navy pilots were categorized according to the four CVD classifications of AMI, CIHD, EBH, and SHD. Five of the 150 pilots were identified from the diagnosis on their death records and, therefore, were excluded from subsequent analyses. Frequency and percentage distributions were compiled by time interval on all medical events (hospital admissions, medical boards, and physical evaluation boards) that occurred after the initial CVD incident. Frequency and percentage distributions also were tabulated on flight and active duty status before and after the initial event in each subsample.

Results

The most serious consequences of CVD included one pilot who died, one pilot who was hospitalized for a second AMI, and 28 men who were rehospitalized, appeared before a medical or physical evaluation board, and/or were retired with a CVD physical disability. For these 30 pilots, or 20.7% of the CVD subpopulation, almost all of the rehospitalizations occurred during the first 12-month time period after the initial CVD incident, and all of the physical disability retirements were recorded within eight months of the last hospital admission or board appearance. The majority (79.3%) of pilots diagnosed with CVD had no records of subsequent medical events while on active duty.

Almost all of the serious aftereffects were observed in the AMI and CIHD subsamples. Approximately 75% of these medical events were for medical and physical evaluation board appearances while the remaining one-quarter consisted of hospital admissions. Only one pilot was hospitalized for a second AMI; the predominant diagnosis recorded was CIHD. The highest percentages of physical disability retirements were observed in the AMI (13.3%) and CIHD (21.4%) subsamples. Most of the pilots in each subsample continued to serve on active duty or were retired without a physical disability. No incidents of inflight incapacitation because of CVD were observed during the follow-up period; however, only a few pilots, primarily in the SHD subsample, resumed flying after the initial CVD event.

Conclusions

Explanations for these results centered on treatment, age, and prior health status. First, the low rate of rehospitalizations suggested a slower rate of CVD progression than expected. Because only one-quarter of the pilots in the AMI and CIHD subsamples were re-admitted, perhaps it can be inferred that the therapeutic regimens lessened CVD risk factors and the progression of CVD. Pilots diagnosed with EBH and SHD probably received medication for controlling their conditions and were monitored at outpatient facilities instead of being rehospitalized or recommended for a board appearance. Second, the high percentage of retirements corresponded with the fact that the mean age of pilots in the AMI and CIHD subsamples was approximately 43, an average career retirement age. Third, the few retirements attributed to CVD reflected the excellent health status of pilots and the stringent physical and mental standards established for selection and retention. This high level of physical and mental well-being in the pilot population no doubt contributed to the low total CVD incidence and disability rates.

Recommendations

While these results provide evidence supportive of the Navy's standards for selection and retention and the types of health care prescribed, subsequent research should prospectively follow these pilots throughout their naval careers and into retirement. Results of such a project not only would further our understanding of the progression of CVD but would determine with considerable confidence the effectiveness of treatment developed by the medical department of the U.S. Navy.

Longitudinal Study of Cardiovascular Disease in U.S. Navy Pilots

While cardiovascular disease (CVD) continues to be the leading cause of death among U.S. males, mortality rates for these conditions have declined more than 30% during the past 30 years (7). This decrease in rates has been attributed to such factors as dietary changes, development of medication to reduce serum cholesterol levels and to control hypertension, decreases in cigarette smoking, increases in the performance of by-pass surgery and the practice of cardiopulmonary resuscitation, advances in coronary care, and modifications in other aspects of life such as an adherence to relaxation techniques or a stress management regimen (6,8,11). Participation in a physical conditioning program also has been demonstrated to help individuals improve their aerobic fitness and modify their life styles which, in turn, have reduced several CVD risk factors (2).

Even with this significant decline in mortality rates, the risk of CVD is a fear of many people, particularly as they approach the mid-life years. This apprehension centers not only on the threat of CVD itself but also on the effects of such a serious illness on the quality of their lives after the incident. Little, however, has been reported on the consequences of CVD, especially with regard to an individual's career status and medical care involvement.

The U.S. military and civilian aviation communities also are concerned about the consequences of CVD, primarily because these can include such catastrophic occurrences as inflight incapacitation and the loss of life and aircraft. Although inflight incapacitation attributed to CVD is an uncommon event (e.g., an annual average of 6 has been reported among general aviation pilots (10) and only 5 cases of inflight myocardial infarction suspected during an 11-year period for the USAF (12)), the costs of death benefits, disability, rehabilitation, medical care, and personnel replacements have reached astronomical levels. In 1980, DeHart (3) stated that death or disability from coronary heart disease in the USAF accounted for approximately $50 million annually. Cardiovascular disease is the leading reason given for a medical disqualification on the medical waiver file among USAF pilots and navigators (13).

The purpose of this longitudinal study was to assess the aftereffects of CVD in U.S. Navy pilots who had been diagnosed with acute myocardial infarction (AMI), chronic ischemic heart disease (CIHD), essential benign hypertension (EBH), or symptomatic heart disease (SHD) during a 12.5-year time period. The specific subsequent life events that were examined included deaths, hospital admissions, medical boards, physical evaluation boards, flight status, and active duty status.

DATA AND METHODS

During the time frame of July 1967 to December 1979, 150 U.S. Navy Caucasian male pilots were diagnosed with CVD. These pilots represented less than 0.7% of all pilots (n = 22,245) included on the Individual Flight Activity Reporting System file which was provided to the Naval Health Research Center, San Diego, by the Naval Safety Center in Norfolk, Virginia. Data extracted from this file included first and last years of flight status. Information on such career status variables as date and reason for separation from active duty was obtained from the Officer Career History file maintained at the Naval Health Research Center. A more detailed description of this sample is presented in a recently published report that examined such CVD risk factors as age, previous hospitalizations, aircraft model primarily flown, carrier landings, total hours flown, and combat hours (5).

On the basis of diagnoses reported on records of deaths, hospitalizations, medical boards, and physical evaluation boards, the 150 pilots were categorized according to the four CVD classifications listed above: AMI, CIHD, EBH, and SHD. Diagnoses corresponded with the numeric coding system published in the Eighth Revision of the International Classification of Diseases Adapted for Use in the United States (ICDA-8). As listed in this nomenclature, the specific conditions subsumed under SHD included congestive heart failure, left ventricular failure, cardiac arrest, other heart block, atrial fibrillation or flutter, paroxysmal tachycardia, etc. Five of the 150 pilots were identified from a diagnosis on their death records, which was the sole indication of CVD. The underlying cause of death for one SHD pilot was multiple injuries resulting from an aviation accident. The records for these 5 pilots were excluded from analyses of subsequent CVD incidents.

In assessing all CVD medical events that occurred after the initial incident, frequency and percentage distributions were compiled on the diagnoses for deaths, hospitalizations, medical boards, and physical evaluation boards as well as the dates of these incidents for each of the four subsamples. All cardiovascular and cerebrovascular diseases listed in the ICDA-8 coding system, such as arteriosclerosis, angina pectoris, or cerebral hemorrhage, were included in these compilations. It should be noted that a medical board typically determines whether or not an individual should return to full active duty whereas a physical evaluation board ascertains the extent of disability incurred and the amount of compensation to be awarded. Death data were only available for the 1974-79 time period.

Frequency and percentage distributions also were tabulated in each subsample for flight and active duty status before and after the initial CVD event. These data were available throughout most of 1980 which provided additional follow-up information beyond the final possible hospitalization date of December 1979.

RESULTS

Medical Events and Time Intervals during Follow-up

As shown in Table I, the proportion of each subsample with a subsequent CVD medical event ranged from 9.1% for pilots in the EBH subsample to 67.9% for those diagnosed with CIHD. One pilot (from the CIHD subsample) died more than 5 years after his first CVD incident and one month after being hospitalized for SHD. Percentages of pilots who had no rehospitalizations or board appearances varied from 28.6% for the CIHD subsample to 90.9% for EBH pilots; 79.3% of all CVD pilots had records of no subsequent medical events.

Rehospitalizations. Of the 145 pilots in this subpopulation, 21 were rehospitalized for CVD, primarily with a diagnosis of CIHD. Only one pilot was hospitalized for a second AMI; another was diagnosed with AMI as a secondary diagnosis to arteriosclerosis. The highest percentages of rehospitalizations were observed in the CIHD and AMI subsamples (28.6% and 23.3%, respectively, versus 6.8% for EBH pilots and 7.0% for the SHD group).

Physical evaluation and medical boards. Also shown in Table I, pilots in the AMI and CIHD subsamples had the highest percentages of physical evaluation board appearances (30.0% and 28.6%, respectively). The proportions of each

TABLE I. MEDICAL EVENTS FOR U.S. NAVY PILOTS SUBSEQUENT TO CARDIOVASCULAR DISEASE (CVD) INCIDENT, 1967-79.

	Diagnostic Category							
	Acute Myocardial Infarction		Chronic Ischemic Heart Disease		Essential Benign Hypertension		Symptomatic Heart Disease	
Subsequent CVD Event	No. of Pilots	%	No. of Pilots	%	No. of Pilots	%	No. of Pilots	%
Death (1974-79 only)	0	0	1	3.6	0	0	0	0
Medical event	18	60.0	19	67.9	4	9.1	5	11.6
Hospitalization only	2	6.7	2	7.1	3	6.8	1	2.3
Hospitalization and medical board	1	3.2	5	17.9	0	0	0	0
Hospitalization and physical evaluation board	2	6.7	0	0	0	0	2	4.7
Hospitalization, medical board, and physical evaluation board	2	6.7	1	3.6	0	0	0	0
Medical board only	6	20.0	4	14.3	1	2.3	1	2.3
Medical board and physical evaluation board	2	6.7	2	7.1	0	0	0	0
Physical evaluation board only	3	10.0	5	17.9	0	0	1	2.3
No medical event	12	40.0	8	28.6	40	90.9	38	88.4
Total	30	100.0	28	100.1	44	100.0	43	100.0

subsample that had one or more medical board apperances were 36.7% for AMI pilots, 42.9% for the CIHD subsample, and 2.3% for the other two groups.

Time interval between CVD hospitalizations. For three of the four subsamples, almost all of the CVD rehospitalizations occurred during the first 12-month period after the initial incident: 10 of 11 admissions (90.9%) in the AMI group, 14 of 17 hospitalizations (82.4%) in the CIHD subsample, and 100.0% in the SHD group. All of the rehospitalizations for the EBH groups were recorded within 18 months of the first CVD incident. The other 4 rehospitalizations for the AMI and CIHD subsamples occurred within 3 and one-quarter years.

Flight Status of Pilots with CVD

As shown in Table II, pilots who were no longer flying at the time of the initial CVD incident ranged from 21.3% for the SHD subsample to 45.2% for the AMI subsample. Differences across groups also were noted for percentages of pilots who had either stopped flying shortly before or were "grounded" after the initial event (i.e., 36.2% to 50.0%). At the end of the follow-up period, the largest proportions of pilots on active flight status were observed for the subgroups of SHD (42.6%) and EBH (18.2%). For the 4 pilots in the AMI and CIHD subgroups who were listed on active flight status, one pilot (from the CIHD subsample) had flown a total of 50-100 hours; the other three had flying time records of less than 50 hours, of which large proportions were allocated to special crew hours.

Active Duty Status of Pilots with CVD

Across the four subsamples, the highest percentages of physical disability retirements were observed for the CIHD and AMI subsamples (21.4% and 13.3%), as contrasted with 4.7% for the SHD and none for the EBH group (see Table III). The proportions of all other retirements fell within a range from 18.6% for the SHD subsample to 50.0% for pilots in the AMI group. As expected, the lowest percentage of pilots listed on active duty after the initial CVD incident was for the AMI group and the highest for SHD pilots.

All of the physical disability retirements occurred within 8 months of the physical evaluation board appearance or initial CVD incident. The other retirements and separations tended to occur during the first 12 months after the initial CVD event; the percentages ranged from 39.3% for the CIHD group to

TABLE II. FLIGHT STATUS OF U.S. NAVY PILOTS BEFORE AND AFTER A CARDIOVASCULAR DISEASE INCIDENT, 1967-79.

	Diagnostic Category							
	Acute Myocardial Infarction		Chronic Ischemic Heart Disease		Essential Benign Hypertension		Symptomatic Heart Disease	
Flight Status	No. of Pilots*	%	No. of Pilots	%	No. of Pilots	%	No. of Pilots*	%
Prior discontinuation	14	45.2	12	42.9	16	36.4	10	21.3
Inactive close to event	15	48.4	14	50.0	20	45.4	17	36.2
Active flight status	2	6.4	2	7.1	8	18.2	20	42.6
Total	31	100.0	28	100.0	44	100.0	47	100.1

*Includes one pilot in the acute myocardial infarction subsample and two in the symptomatic heart disease subsample who were listed on flight status at the time of their deaths. Two pilots in the symptomatic heart disease subsample had discontinued flying prior to their deaths.

TABLE III. CAREER STATUS OF U.S. NAVY PILOTS SUBSEQUENT *TO CARDIOVASCULAR DISEASE (CVD) INCIDENT, 1967-79.*

	Diagnostic Category							
	Acute Myocardial Infarction		Chronic Ischemic Heart Disease		Essential Benign Hypertension		Symptomatic Heart Disease	
Subsequent Career Status	No. of Pilots	%	No. of Pilots	%	No. of Pilots	%	No. of Pilots	%
Death (1974-79 only)	0	0	1	3.6	0	0	0	0
Retirement: physical disability for CVD	4	13.3	6	21.4	0	0	2	4.7
Retirement: other types	15	50.0	11	39.3	20	45.4	8	18.6
Resignation	3	10.0	0	0	5	11.4	4	9.3
Active duty	8	26.7	10	35.7	19	43.2	29	67.4
Total	30	100.0	28	100.0	44	100.0	43	100.0

50.0% for pilots with SHD. The remaining separations fell within a range from one year, one month to seven years, four months.

DISCUSSION

Overall, the most serious consequences of CVD included one pilot who died, one pilot who was hospitalized for a second AMI, and 28 men who were rehospitalized, appeared before a medical or physical evaluation board, and/or were retired with a physical disability because of CVD. Of these 30 cases or 20.7% of the 145 CVD pilots, the majority of rehospitalizations occurred during the first 12-month time period after the initial CVD incident, and all of the physical disability retirements were recorded within 8 months of the last hospital admission or board appearance.

These serious aftereffects of CVD were evidenced with greatest frequency in the AMI and CIHD subsamples: 60% or more of these pilots experienced a subsequent CVD event after the initial incident. Approximately 75% of these events, however, were for appearances before a medical or physical evaluation board which typically are convened to determine a pilot's progress, prognosis, and disposition subsequent to his initial CVD event. The remaining one-quarter of these pilots had been rehospitalized, only one of whom was admitted because of a second AMI while almost all of the others were diagnosed with CIHD. If a re-admission can be considered an indication of CVD progression, this 25% rehospitalization rate would be lower than expected. McGranahan and his associates (9), for example, stated that coronary atherosclerotic heart disease progresses in at least one-half of the patients who have been restudied, and the rate of progression seems to be correlated with risk factors of CVD. Because of the relatively low rate of re-admissions for CVD, perhaps it can be inferred that the therapeutic regimens lessened CVD risk factors and slowed the progression of this disease constellation in pilots.

The lower percentages of rehospitalizations and board appearances for EBH and SHD pilots suggested that a different type of treatment was prescribed for these conditions. Instead of a rehospitalization or a board appearance, these pilots probably received medication for controlling their condition and were monitored at an outpatient medical facility. Medication for EBH, for example, has been highly effective in lowering elevated blood pressure levels and enabling many pilots to resume their flying duties (1,4). Before prescribing

drug therapy, however, most physicians and health promotion specialists probably would recommend individualized therapeutic regimens to reduce weight and body fat, improve physical conditioning, and decrease sodium intake (1,4) as well as to eliminate tobacco (4).

Other results showed that only a few pilots in the AMI, CIHD, and EBH subsamples resumed flying after the initial CVD incident. No cases of inflight incapacitation because of CVD were observed during the follow-up period; both the pilot who died on active duty and the pilot who suffered a second AMI had stopped flying at least 2 years before these incidents.

Although few pilots remained on active flight status, large proportions of each subsample continued to serve on active duty or were retired without a physical disability. Explanations for these findings centered on the factors of age, prior health status, and treatment. First, the high percentage of nondisability retirements corresponded with the mean age of pilots in the AMI and CIHD subsamples (5). Because their mean age was 43, many pilots may have decided to retire from active duty after experiencing the initial CVD incident. Second, the finding that few retirements occurred because of a CVD disability seemed to be a reflection of the excellent health status of pilots in general and the stringent physical and mental standards established for selection and retention in particular. The relatively high number of pilots on active duty and the overall low incidence of CVD in this population also underscored their high level of physical and mental well-being. Third, as noted above, the types of treatment prescribed probably were influential in reducing CVD risks and improving the health-promoting life style of pilots with CVD.

These results also pointed up that 79.3% of this subpopulation had records of no subsequent medical events. While the overall findings of this study provide evidence supportive of the Navy's standards for selection and retention and the types of health care prescribed, subsequent research should prospectively follow these pilots throughout their naval careers and into retirement. Results of such a project not only would further our understanding of the progression of CVD but would determine with considerable confidence the effectiveness of treatment developed by the medical department of the U.S. Navy.

REFERENCES

1. Berry MA, Wick RL, Jr. Hypertension in the civilian flying population: significant or not? Aviat. Space Environ. Med. 1978; 49:78-80.
2. Brown TE, Myles WS, Allen CL. The relationship between aerobic fitness and certain cardiovascular risk factors. Aviat. Space Environ. Med. 1983; 54:543-7.
3. DeHart RM. Coronary heart disease: an expensive Air Force problem. Aviat. Space Environ. Med. 1980; 51:1057-63.
4. Fuchs HS. Hypertension and orthostatic hypotension in applicants for flying training and aircrew. Aviat. Space Environ. Med. 1983; 54:65-8.
5. Hoiberg A. Cardiovascular disease among U.S. Navy pilots. Aviat. Space Environ. Med. In press.
6. Kaplan RM. The connection between clinical health promotion and health status. Am. Psychol. 1984; 39:755-65.
7. Levy RI, Moskowitz J. Cardiovascular research: decades of progress, a decade of promise. Science 1982; 217:121-9.
8. Matarazzo JD. Behavioral health's challenge to academic, scientific, and professional psychology. Am. Psychol. 1982; 37:1-14.
9. McGranahan GM, Jr, Hickman JR, Jr, Uhl GS, Montgomery MA, Triebwasser JH. Minimal coronary artery disease and continuation of flying status. Aviat. Space Environ. Med. 1983; 54:548-50.
10. Mohler SR, Booze CF. U.S. fatal general aviation accidents due to cardiovascular incapacitation: 1974-75. Aviat. Space Environ. Med. 1978; 49:1225-8.
11. Patel C. Primary prevention of coronary heart disease. In: Surwit RS, Williams RB, Jr, Steptoe A, Biersner R, eds. Behavioral treatment of disease. New York, NY: Plenum Press, 1982:23-41.
12. Rayman RB, McNaughton GB. Sudden incapacitation: USAF experience, 1970-80. Aviat. Space Environ. Med. 1983; 54:161-4.
13. Whitton RC. Medical disqualification in USAF pilots and navigators. Aviat. Space Environ. Med. 1984; 55:332-6.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 85-7	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* LONGITUDINAL STUDY OF CARDIOVASCULAR DISEASE IN U.S. NAVY PILOTS		5. TYPE OF REPORT & PERIOD COVERED Interim 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Anne Hoiberg		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Health Research Center P.O. Box 85122 San Diego, California 92138-9174		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62758N MF58.01A-0001
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Medical Research & Development Command Naval Medical Command, National Capital Region Bethesda, Maryland 20814		12. REPORT DATE February 1985 13. NUMBER OF PAGES 13
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* Commander, Naval Medical Command Department of the Navy Washington, DC 20372		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

Approved for public release; distribution unlimited.

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Longitudinal study
Cardiovascular disease (CVD)
U.S. Navy pilots
Morbidity (hospitalizations and medical boards)
Mortality
Physical disability
Flight status

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This longitudinal study examined the consequences of cardiovascular disease (CVD) in 145 U.S. Navy pilots who suffered a CVD incident during the 1967-79 time period. Results showed that one pilot died (data were only available for 1974-79), one suffered a second myocardial infarction, and 28 pilots were hospitalized and/or retired with a physical disability because of CVD. The other 79.3% of this pilot subpopulation continued on active duty, retired with no physical disability, or resigned from service. The majority of

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

subsequent CVD incidents occurred during a 12-month period after the initial CVD event; 35% had discontinued flying prior to the initial CVD incident. These findings reflected not only the few CVD cases in this population of 22,245 pilots who served for some time from 1967-79, but also the few after-effects of CVD.

END

FILMED

6-85

DTIC